This key should allow you to understand why you choose the option you did (beyond just getting a question right or wrong). More instructions on how to use this key can be found here.

If you have a suggestion to make the keys better, please fill out the short survey here.

Note: This key is auto-generated and may contain issues and/or errors. The keys are reviewed after each exam to ensure grading is done accurately. If there are issues (like duplicate options), they are noted in the offline gradebook. The keys are a work-in-progress to give students as many resources to improve as possible.

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1. Simplify the expression below and choose the interval the simplification is contained within.

$$19 - 18^2 + 6 \div 9 * 11 \div 3$$

The solution is -302.556, which is option C.

A. $[-306.98, -303.98]$

-304.980, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

B. $[343.44, 350.44]$

345.444, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

C. $[-303.56, -299.56]$

* -302.556, this is the correct option

D. $[338.02, 345.02]$

343.020, which corresponds to two Order of Operations errors.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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2. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{0}{11\pi} + \sqrt{9}i$$

The solution is Pure Imaginary, which is option E.

A. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3 + 5)

B. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

C. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Pure Imaginary

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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3. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{-54 + 88i}{2 + 4i}$$

The solution is $12.20 + 19.60i$, which is option E.

A. $a \in [243, 246]$ and $b \in [19, 20]$

$244.00 + 19.60i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

B. $a \in [-24, -22.5]$ and $b \in [-2.5, -1.5]$

$-23.00 - 2.00i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [-28, -26.5]$ and $b \in [21, 23]$

$-27.00 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [10.5, 12.5]$ and $b \in [390.5, 393]$

$12.20 + 392.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

E. $a \in [10.5, 12.5]$ and $b \in [19, 20]$

* $12.20 + 19.60i$, which is the correct option.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.

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4. Choose the **smallest** set of Real numbers that the number below belongs to.

$$-\sqrt{\frac{4225}{25}}$$

The solution is Integer, which is option D.

A. Whole

These are the counting numbers with 0 (0, 1, 2, 3, ...)

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Integer

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to -65.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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5. Simplify the expression below and choose the interval the simplification is contained within.

$$11 - 12^2 + 5 \div 16 * 2 \div 3$$

The solution is -132.792, which is option B.

A. $[155.1, 155.41]$

155.208, which corresponds to an Order of Operations error: multiplying by negative before squaring. For example: $(-3)^2 \neq -3^2$

B. $[-132.91, -132.73]$

* -132.792, this is the correct option

C. $[-133.09, -132.89]$

-132.948, which corresponds to an Order of Operations error: not reading left-to-right for multiplication/division.

D. $[154.88, 155.12]$

155.052, which corresponds to two Order of Operations errors.

E. None of the above

You may have gotten this by making an unanticipated error. If you got a value that is not any of the others, please let the coordinator know so they can help you figure out what happened.

General Comment: While you may remember (or were taught) PEMDAS is done in order, it is actually done as P/E/MD/AS. When we are at MD or AS, we read left to right.

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6. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(2 - 10i)(5 + 8i)$$

The solution is $90 - 34i$, which is option C.

A. $a \in [-70, -65]$ and $b \in [61, 72]$

$-70 + 66i$, which corresponds to adding a minus sign in the first term.

B. $a \in [87, 93]$ and $b \in [30, 38]$

$90 + 34i$, which corresponds to adding a minus sign in both terms.

C. $a \in [87, 93]$ and $b \in [-37, -31]$

* $90 - 34i$, which is the correct option.

D. $a \in [-70, -65]$ and $b \in [-69, -63]$

$-70 - 66i$, which corresponds to adding a minus sign in the second term.

E. $a \in [7, 14]$ and $b \in [-82, -77]$

$10 - 80i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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7. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$(-8 + 4i)(5 + 7i)$$

The solution is $-68 - 36i$, which is option E.

A. $a \in [-69, -62]$ and $b \in [33, 39]$

$-68 + 36i$, which corresponds to adding a minus sign in both terms.

B. $a \in [-16, -4]$ and $b \in [-77, -75]$

$-12 - 76i$, which corresponds to adding a minus sign in the first term.

C. $a \in [-41, -38]$ and $b \in [25, 29]$

$-40 + 28i$, which corresponds to just multiplying the real terms to get the real part of the solution and the coefficients in the complex terms to get the complex part.

D. $a \in [-16, -4]$ and $b \in [74, 83]$

$-12 + 76i$, which corresponds to adding a minus sign in the second term.

E. $a \in [-69, -62]$ and $b \in [-38, -35]$

* $-68 - 36i$, which is the correct option.

General Comment: You can treat i as a variable and distribute. Just remember that $i^2 = -1$, so you can continue to reduce after you distribute.

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8. Choose the **smallest** set of Real numbers that the number below belongs to.

$$\sqrt{\frac{140625}{625}}$$

The solution is Whole, which is option D.

A. Integer

These are the negative and positive counting numbers (..., -3, -2, -1, 0, 1, 2, 3, ...)

B. Not a Real number

These are Nonreal Complex numbers **OR** things that are not numbers (e.g., dividing by 0).

C. Rational

These are numbers that can be written as fraction of Integers (e.g., -2/3)

D. Whole

* This is the correct option!

E. Irrational

These cannot be written as a fraction of Integers.

General Comment: First, you **NEED** to simplify the expression. This question simplifies to 375.

Be sure you look at the simplified fraction and not just the decimal expansion. Numbers such as 13, 17, and 19 provide **long but repeating/terminating decimal expansions!**

The only ways to *not* be a Real number are: dividing by 0 or taking the square root of a negative number.

Irrational numbers are more than just square root of 3: adding or subtracting values from square root of 3 is also irrational.

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9. Choose the **smallest** set of Complex numbers that the number below belongs to.

$$\frac{4}{2} + 64i^2$$

The solution is Rational, which is option E.

A. Nonreal Complex

This is a Complex number $(a + bi)$ that is not Real (has i as part of the number).

B. Irrational

These cannot be written as a fraction of Integers. Remember: π is not an Integer!

C. Pure Imaginary

This is a Complex number $(a + bi)$ that **only** has an imaginary part like $2i$.

D. Not a Complex Number

This is not a number. The only non-Complex number we know is dividing by 0 as this is not a number!

E. Rational

* This is the correct option!

General Comment: Be sure to simplify $i^2 = -1$. This may remove the imaginary portion for your number. If you are having trouble, you may want to look at the *Subgroups of the Real Numbers* section.

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10. Simplify the expression below into the form $a + bi$. Then, choose the intervals that a and b belong to.

$$\frac{72 + 44i}{5 + 2i}$$

The solution is $15.45 + 2.62i$, which is option D.

A. $a \in [14.5, 16]$ and $b \in [75, 77]$

$15.45 + 76.00i$, which corresponds to forgetting to multiply the conjugate by the numerator.

B. $a \in [8, 10]$ and $b \in [12, 14]$

$9.38 + 12.55i$, which corresponds to forgetting to multiply the conjugate by the numerator and not computing the conjugate correctly.

C. $a \in [14, 15]$ and $b \in [20.5, 22.5]$

$14.40 + 22.00i$, which corresponds to just dividing the first term by the first term and the second by the second.

D. $a \in [14.5, 16]$ and $b \in [1.5, 3]$

* $15.45 + 2.62i$, which is the correct option.

E. $a \in [447.5, 449]$ and $b \in [1.5, 3]$

$448.00 + 2.62i$, which corresponds to forgetting to multiply the conjugate by the numerator and using a plus instead of a minus in the denominator.

General Comment: Multiply the numerator and denominator by the *conjugate* of the denominator, then simplify. For example, if we have $2 + 3i$, the conjugate is $2 - 3i$.
